Application Note: **AC Coupling**

Why AC Coupling?

AC coupling enables customers to interface Pika Energy's X3001 grid-tied inverter with battery storage for both on and off grid use. Utilizing a pure sine wave battery based standalone inverter/charger, (such as the Magnum ME-PAE series or Schneider Conext XW+) enables battery charging from the utility as well as from a Pika Energy system.

How does it work?

By coupling the output of Pika Energy's X3001 inverter to a battery based standalone inverter/charger (see list of compatible inverters) batteries may be charged from the utility, a PV array or a Pika X3001. Currently AC coupling is only available with standalone inverters/chargers where no power from the system can flow back onto the grid. Power may be provided from the utility if a grid connection is available and from the batteries in the event of a grid outage or lack of a grid connection entirely. A diversion load controller is used to safely charge batteries from wind and solar.

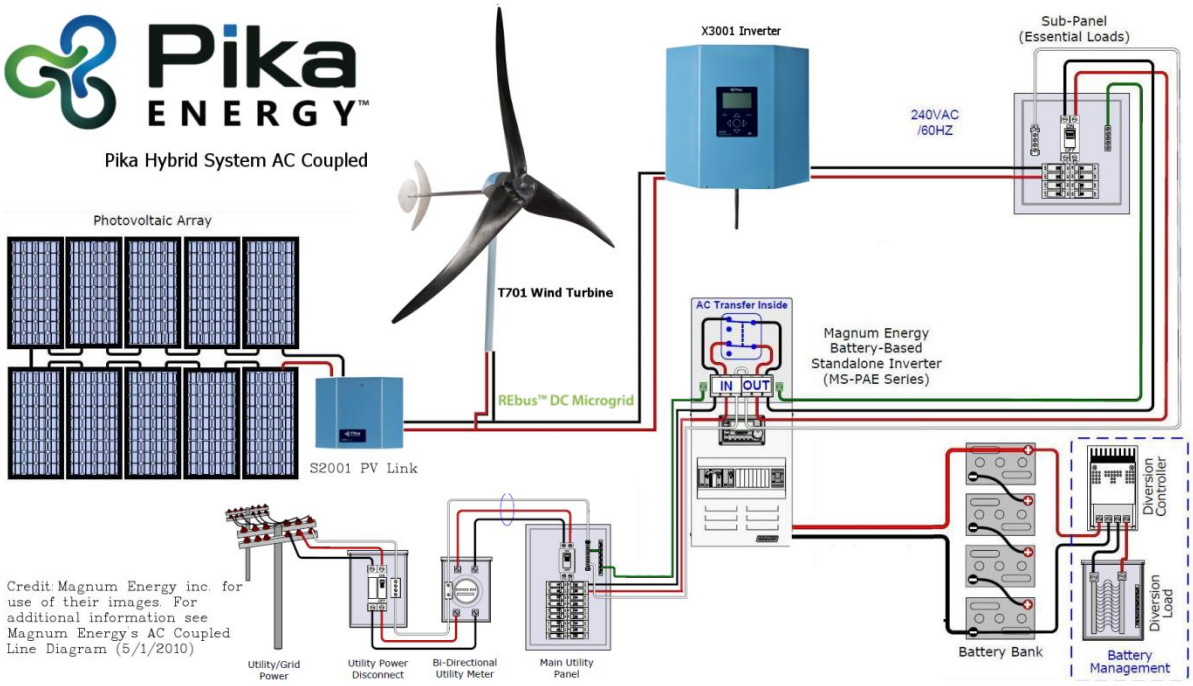

Figure 1 Pika Hybrid System AC Coupled

Application Note: **AC Coupling**

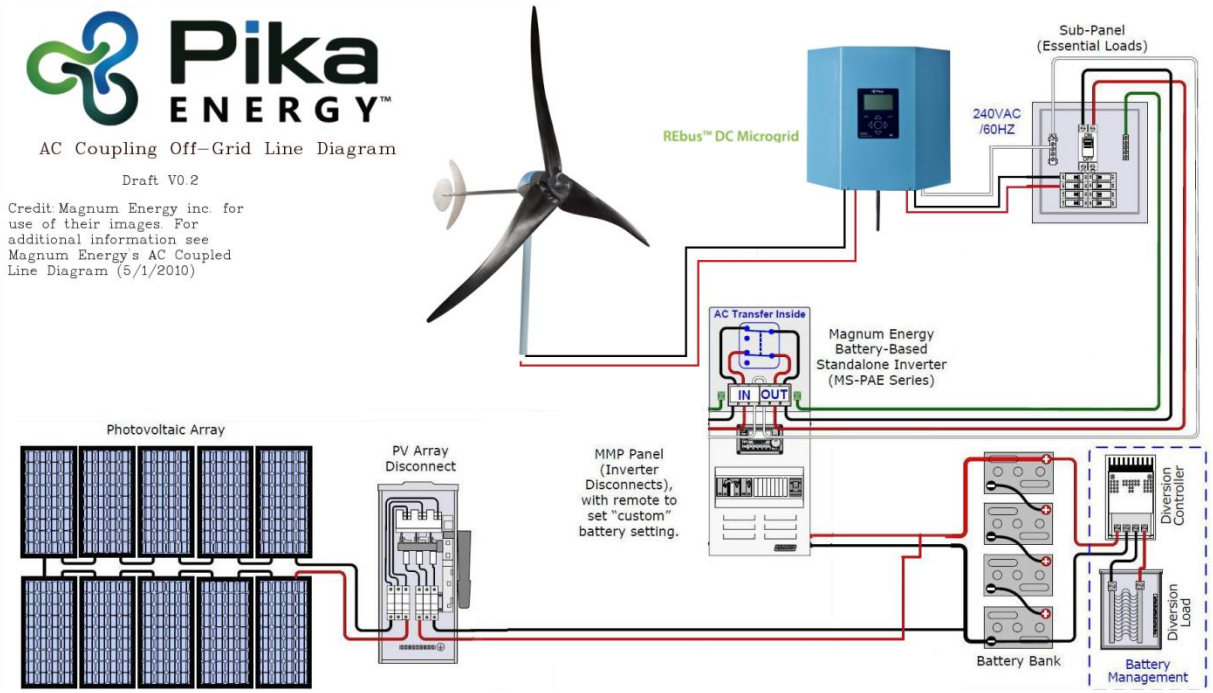

Figure 2 Pika Wind System Off-Grid AC Coupled

The battery based standalone inverter must be configured for the battery chemistry, voltage and capacity of the battery bank by adjusting manufacturer set points to ensure proper charging. Refer to your inverter manual for guidance on which set points to configure. For off-grid users with AC coupled systems, only bulk and float stage battery charging is possible from a Pika system. For off-grid customers, to achieve all three charging stages (absorption, bulk and float) an independent charge controller may be used with a PV array on the battery side of the system. For customers with a connection to the utility, three-stage charging is handled by the built-in functionality of the battery based standalone inverter/charger. For all AC coupled systems, a diversion load controller (see additional required equipment) is required to ensure batteries are not overcharged in times of high input power. When batteries are fully charged, the inverter/charger will create a shift in the AC frequency which alerts the X3001 to safely disconnect.

Pika System Example

Pika recommends the Magnum MS-PAE series of inverters for AC coupled systems. The following outlines the basics of this AC coupled system.

Application Note: **AC Coupling**

Setup and Configuration of a standalone batter based inverter/charger

Configuration of the Magnum ME-PAE series inverters is possible using the remote (ME-ARC or ME-RTR). Under charger setup chose “Custom” battery type and manually enter the set points for absorb, float and equalize that are appropriate for your battery type and voltage. The Magnum inverter will shift its output frequency to 60.4Hz when the battery bank has reached 4V above the specified Float voltage. Consult Pika Energy for questions on configuring your system set points for proper operation.

Diversion Controller

A diversion load controller is needed to provide protection from overcharging batteries. Many different brands of diversion controllers are available and will work in an AC coupled system. Selection of a diversion load is determined by the peak installed generation capacity of the system. The NEC requires redundant diversion loads for any generation system that incorporates batteries, this means two independent diversion controllers and loads.

Programmable relay drivers are also able to act as a diversion controller. If using a relay driver, select relays or contactors that have appropriate contact ratings for the voltage and current for the loads and battery bank. Select the appropriate drive coil voltage for the battery bank.

Some inverter/chargers may include auxiliary relays which can be configured to perform the same operation as a diversion load controller. The Magnum ME-PAE 4448 does not have any auxiliary relays installed.

Batteries

Batteries should be stored in a well ventilated area, far from flammable objects. Follow all manufacturer recommended safety measures for battery wiring and maintenance. Observe all NEC requirements for battery storage. If using a Magnum MS-PAE inverter, install the included battery temperature sensor.

Pika Tested: Magnum ME-PAE 4448 pure sine wave inverter/charger with ME-ARC

Additional Required Equipment:

-Diversion load controller such as Xantrex C40/C60, Tristar C45/C60 equivalent. This diversion controller and diversion load must be sized appropriately for 150% of total generation capacity. A programmable relay driver such as the Morningstar Relay driver will work as a diversion load controller.

Application Note: **AC Coupling**

-Ability to apply custom inverter/charger battery set points. For Magnum MS-PAE inverters ME-ARC or ME-RTR are required. For other inverter/chargers no additional hardware may be required.

Compatible Inverters:

- MS-PAE Series ≥Rev 4.1 or MS/MS-PE Series ≥5.0.
- Schneider Conext XW+
- Xantrex XW Hybrid Inverter/Chargers in the following table:

Model	Firmware Version	Firmware Part Number[a]
Xantrex XW6048 120/240 60	1.05	150-0175-01-05
Xantrex XW4548 120/240 60	1.04	150-0176-01-04
Xantrex XW4024 120/240 60	1.04	150-0177-01-04

a.The last two fields are the same as the firmware version. Make sure your firmware's part number matches or is higher than (based on the last two fields) what is listed in the table.

- Any standalone battery based inverter/charger with user adjustable battery charging set points and frequency shifting capability.

Warranty

Pika Energy offers a 5-year warranty on the T701 Wind Turbine and X3001 Inverter, installing these products in an AC coupled system does not void the warranty in any way.

Notes:

- For using inverter/chargers without a 240V split phase input consult Pika Energy on the selection of a transformer for your application.
- The X3001 is not able to limit its output power based on a frequency shift from another inverter/charger (eg. SMA's frequency-shift power control), if a frequency shift occurs the X3001 will disconnect its output.